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Market Integration in the North American Hog Industries

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Abstract

About 8 percent of the hogs slaughtered in the U.S. in 2004 will originate in Canada—many more than 10 years ago. Canadian hogs have flowed into the U.S. in response to significant structural changes in the U.S. pork industry, concurrent with policy changes in Canada. This, combined with a strong U.S./Canadian dollar exchange rate, created incentives to expand hog operations in Ontario and to start production in Manitoba. In 15 years, an open border and pronounced breeding herd efficiencies helped to increase Canadian hog exports to the United States by more than eight-fold.

Keywords: hogs, pigs, pork, hog industry, imports, trade, Canada, market integration, structural change, policy change.

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Introduction

More than 100 million hogs will be slaughtered in U.S. packing/processing facilities in 2004. About 8 percent of the total U.S. hog slaughter will be of Canadian origin. Of the 8 million Canadian hogs, about two-thirds will be imported as feeder pigs, the other third as slaughter hogs. While almost all imported Canadian slaughter hogs are transported directly to U.S. packer/processing facilities, imported Canadian feeder pigs weighing between 10 and 40 pounds, are purchased by U.S. hog finishers and then housed in finishing barns, typically in Corn Belt States. Over a 6-month period, feeder pigs are each fed about 750 pounds of a ration comprised mainly of corn and soybean meal. When the animals reach about 260 pounds, they are sold to packer/processors and slaughtered.

The 8 million hogs imported from Canada in 2004 far eclipse the 1 million head imported just 15 years ago. The composition of hog imports has changed over time as well. In 1989, just 16 percent of imported Canadian hogs were feeder pigs, versus close to 65 percent of hog imports in 2004. The growth and re-composition of U.S. demand for Canadian hogs raises two questions: What economic factors changed to create the Canada-to-U.S. flow of hogs, and why are hog imports now mostly feeder pigs?

In a nutshell, Canadian hogs flowed into the U.S. in response to significant structural changes¹ in the U.S. pork industry, concurrent with important policy changes in Canada. This, combined with a strong U.S./Canadian dollar exchange rate, created incentives to expand hog operations in Ontario and start production in Manitoba. In 15 years, an open border and pronounced breeding herd efficiencies helped to increase Canadian hog exports to the United States more than eight-fold.

¹ Structural change typically addresses issues concerning changes in numbers of buyers and sellers, product differentiation, cost structures, and vertical coordination/integration of an industry.

Some Background, History, and Context

Canada is by far the primary exporter of live swine to the United States, accounting for more than 99 percent of U.S. imports (tables 1a and 1b). Canada's dominance of U.S. swine imports is due largely to a shared border that extends almost 3,500 miles between the Pacific and Atlantic Oceans. Such proximity between buyer and seller is necessary in trading so many live animals.

The feeder pig share of total U.S. swine imports has increased from about 16 percent in 1989 to more than 66 percent in 2004. The slaughter hog share of U.S. imports has declined from about 84 percent in 1989 to 32 percent in 2004, with breeding animals making up the balance (table 1b).

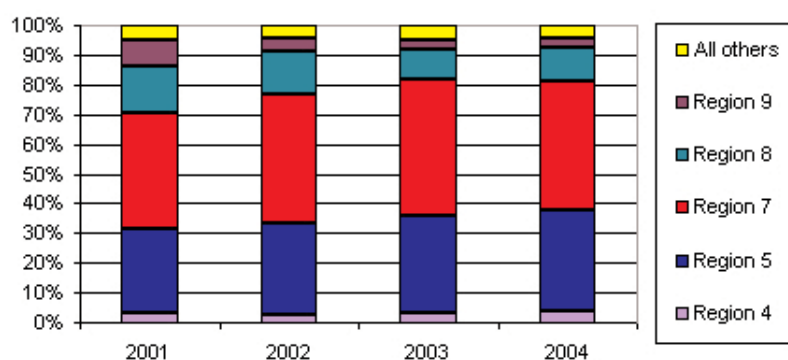
Where do the Canadian hogs go once they are imported into the United States? A data series published weekly by USDA's Agricultural Marketing Service (AMS) reports import destinations on a regional basis. Most Canadian swine imported into the United States from 2001 to 2004 were shipped to major feed grain producing States or to packer/processors in hog-deficit regions (fig. 1).

Table 1a—Number of swine imported by the United States, 1990-2004

Description and country of origin	1990	1995	2000	2001	2002	2003	2004*
<i>Number of animals</i>							
Purebred breeding animals:							
World	1,376	1,873	4,585	21,428	14,977	8,846	3,461
Canada	108	639	4,056	21,428	14,977	8,846	3,461
Swine weighing less than 50 kg:							
World	204,184	651,096	2,336,048	3,163,962	3,757,882	2,301,551	na
Canada	203,700	650,518	2,335,848	3,163,962	3,757,882	2,301,551	na
Less than 7 kg	-	-	-	-	-	1,446,950	2,103,800
= > 7 kg but <23 kg	-	-	-	-	-	348,588	421,099
23 - 50 kg	-	-	-	-	-	873,955	1,307,147
Swine weighing 50 kg or more:							
World	684,692	1,097,169	933,514	-	-	-	na
Canada	682,469	1,096,003	933,514	-	-	-	na
Swine weighing > 50 kg for immediate slaughter:							
World	-	-	1,005,666	1,969,995	1,808,075	2,215,663	1,697,324
Canada	-	-	1,005,666	1,969,995	1,808,075	2,215,663	1,697,324
Swine weighing > 50 kg not for immediate slaughter:							
World	-	-	77,751	182,303	159,741	242,701	141,677
Canada	-	-	77,751	182,303	159,139	242,510	141,131

- = negligible, na = not available. * = year to date.

Source: Compiled by Economic Research Service/USDA.

Figure 1. Destinations of imported Canadian swine, 2001-2004

Region 4= AL, FL, GA, KY, MS, NC, SC, TN

Region 5= IL, IN, MI, MN, OH, WI

Region 7= IA, KS, MO, NE

Region 8= CO, MT, ND, SD, UT, WY

Region 9= AZ, CA, HI, NV

Source: USDA.

Table 1b—Swine imported from Canada by the United States, 1990-2004

Item	1990	1995	2000	2001	2002	2003	2004*
<i>Number of animals</i>							
Total number of swine imported into the U.S.	890,252	1,750,138	4,357,564	5,337,688	5,740,675	7,438,254	5,674,508
<i>Percent</i>							
U.S. imports of:							
Canadian origin	99.55	99.83	99.98	99.99	99.99	99.99	99.99
Non-Canadian origin	0.4	0.2	>.1	>.1	>.1	>.1	>.1
Breeding animals as a share of U.S. swine imports	0.2	0.1	0.1	0.4	0.3	0.1	0.1
Slaughter hogs as a share of U.S. swine imports	76.9	62.7	46.3	40.3	34.3	33.1	32.4
Feeder pigs as a share of U.S. swine imports	22.9	37.2	53.6	59.3	65.5	66.8	67.5

* Year to date.

Source: Compiled by Economic Research Service/USDA.

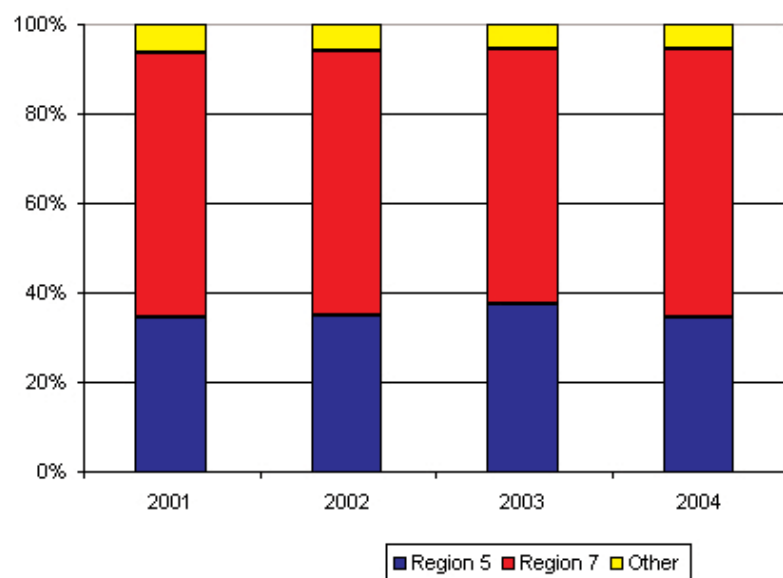
Figure 2. Destination of U.S. imports of Canadian feeder pigs, 2001-2004

Table 2—Ranking of States/Provinces for movement of pigs, 2002-04

Rank	State/Province of origin	Percent of hogs
1	Iowa	16.6
2	Oklahoma	15.5
3	Manitoba	14.3
4	Ontario	8.2
5	Nebraska	6.8
6	Minnesota	6.5
7	Missouri	6.0
	Others*	26.1

Rank	State/Province of destination	Percent of hogs
1	Iowa	38.0
2	Minnesota	15.6
3	Nebraska	8.4
4	Indiana	5.6
5	Illinois	4.4
6	Missouri	2.2
	Others**	25.7

*Others =Combined volumes of States whose individual share < 6 percent.

**Others =Combined volumes of States whose individual share < =1 percent.

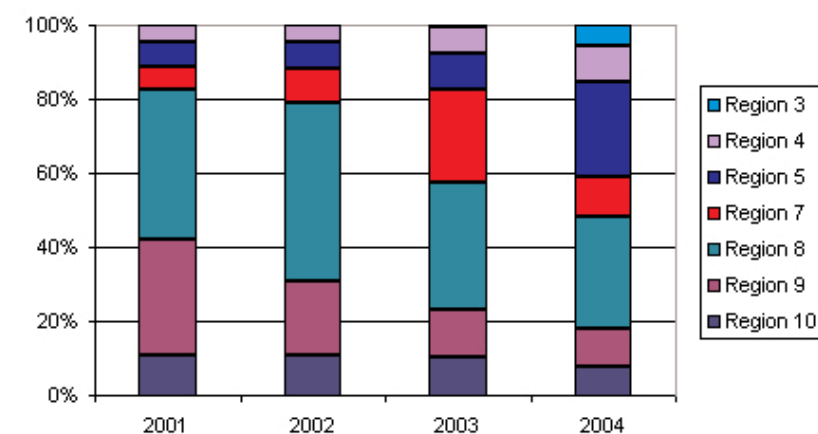
Source: USDA, *National Direct Feeder Pig Report, 2002-2004*.

Some 95 percent of Canadian feeder pigs are shipped to two regions: Region 7 (Iowa, Kansas, Missouri, and Nebraska) and Region 5 (Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin) (fig. 2). Canadian slaughter hogs are exported more widely, to States where packer/processors demand more hogs than are produced regionally. Most Canadian slaughter hogs are shipped to Western, upper Midwestern, and Eastern Corn Belt States (fig. 3). About 60 percent of imported slaughter hogs were transported to packer/processors in Region 8 (Colorado, Montana, North Dakota, South Dakota, Utah, and Wyoming), and Region 9 (Arizona, California, Hawaii, and Nevada). Regions 5 and 7 account for about 25 percent of imported Canadian slaughter hogs.

AMS/USDA also publishes a weekly data series titled “Canadian Live Hog Imports into the United States, by State of Entry.” From 2001 to 2004, 95 percent of Canadian hogs entered the United States through Michigan and North Dakota (fig. 4). Two-thirds of Canadian feeder pigs cross the U.S. border through North Dakota, and the other third via Michigan. More than half of Canadian slaughter hogs enter the United States through North Dakota, likely headed toward a large slaughter plant in South Dakota. Twenty-seven percent of imported slaughter hogs come in through the Western States of Montana and Idaho, suggesting destinations west of the Rocky Mountains, such as California. Eighteen percent of slaughter hogs enter through Michigan, suggesting destinations in Indiana, Kentucky, and Pennsylvania.

A relatively new weekly data series, the “National Direct Feeder Pig Report,” tracks price, volume, origin, and destination of large movements of feeder pigs in the United States. Data from late 2002 to late 2004 show that Iowa, Oklahoma, and Manitoba are the States/Provinces from which the largest share of feeder pigs traded in the United States originate (table 2).

Figure 3. Destination of U.S. imports of Canadian barrows and gilts, 2001-2004



Region 3= DE, MD, PA, WV, VA

Region 4= AL, FL, GA, KY, MS, NC, SC, TN

Region 5= IL, IN, MI, MN, OH, WI

Region 7= IA, KS, MO, NE

Source: USDA.

Region 8= CO, MT, ND, SD, UT, WY

Region 9= AK, AZ, CA, HI, NV

Region 10= ID, OR, WA

Figure 4. Imported Canadian hogs: U.S. state of entry

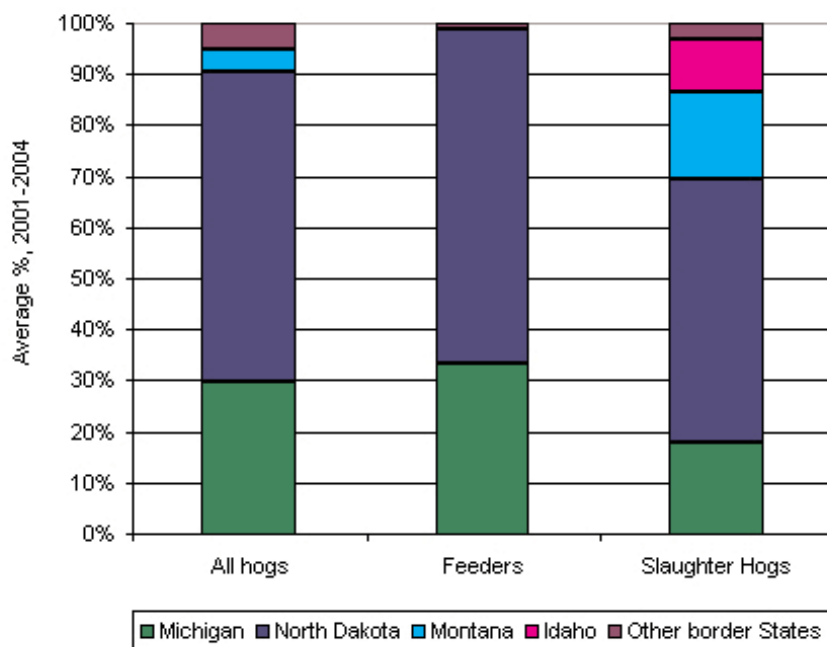


Table 3—Top five States' share of total hogs and pigs, 1980-2003

Year	Rank	State	Share of inventory
			<i>Percent</i>
1980	1	IA	25
	2	IL	10
	3	MN	8
	4	IN	7
	5	MO	6
1985	1	IA	26
	2	IL	10
	3	IN	8
	4	MN	8
	5	NE	7
1990	1	IA	25
	2	IL	10
	3	MN	8
	4	IN	8
	5	NE	8
1995	1	IA	23
	2	NC	14
	3	MN	9
	4	IL	8
	5	NE	7
2000	1	IA	26
	2	NC	16
	3	MN	10
	4	IL	7
		Other States	6
2003	1	IA	26
	2	NC	17
	3	MN	11
	4	IL	7
	5	IN	5

Source: National Agricultural Statistics Service, USDA.

The largest destination States for traded feeder pigs are Iowa (38 percent) and Minnesota (16 percent), falling off rapidly to Nebraska (8 percent). The “other” category in States of origin and destination exceeds 25 percent, suggesting that feeder pig production and finishing is widely dispersed throughout the United States, but clearly concentrated in Corn Belt States, particularly Iowa.

Livestock Follows Grain...And Packer/Processors Follow Livestock

Corn Belt States² have always been the primary pork-producing region of the United States. The reason for the region's dominance is simple: Corn Belt States together are the largest producers in the world of the two optimal inputs of hog feed rations—corn and soybeans. Commodity prices tend to

² Iowa, Missouri, Illinois, Indiana, and Ohio.

Table 4—Commercial hog slaughter for top 5 States, 1980-2003

Year	Rank	State	Share of commercial slaughter
			<i>Percent</i>
1980	1	Iowa	26.5
	2	Illinois	7.8
	3	Minnesota	5.9
	4	Ohio	5.5
	5	Michigan	4.9
1985	1	Iowa	25.0
	2	Illinois	8.9
	3	Michigan	6.0
	4	Nebraska	6.0
	5	Minnesota	5.5
1990	1	Iowa	30.3
	2	Illinois	10.4
	3	Minnesota	6.9
	4	Nebraska	6.3
	5	S. Dakota	5.2
1995	1	Iowa	31.3
	2	Illinois	9.6
	3	N. Carolina	7.9
	4	Minnesota	7.4
	5	S. Dakota	6.3
2000	1	Iowa	28.2
	2	N. Carolina	10.1
	3	Illinois	9.8
	4	Minnesota	8.2
	5	Indiana	6.4
2003	1	Iowa	29.0
	2	N. Carolina	10.8
	3	Minnesota	8.9
	4	Illinois	8.2
	5	Indiana	7.0

Source: USDA National Agricultural Statistics Service.

be lowest at their production points, and corn and soybeans are no exception. With feed costs accounting for 50-55 percent of the cost of producing a slaughter-ready hog,³ profit-maximizing behavior dictates that hog production be situated where feed costs are minimized. From 1980 to 2003, Corn Belt States have accounted for almost half of the U.S. hog inventory (table 3). So in terms of U.S. hogs and grain production, the old adage “Livestock follows grain” rings true.

Iowa is by far the largest pork-producing State in the United States, largely by virtue of its huge grain production base. Over the past 25 years, Iowa has been the largest producer of corn and soybeans in the United States.⁴ Iowa also hosts a significant number of U.S. slaughter/processing facilities averaging about 28 percent of U.S. hog slaughter from 1980 to 2003 (table 4). Packer/processors will cluster near hog production to minimize costs of

³ *Hog Enterprise Budgets 1999-2003*. John Lawrence, Iowa State University.

⁴ In 1980-2004, Iowa was the largest corn-producing State in all years except 1993. For soybeans, Iowa was the largest producing State in 14 of the last 25 years. Illinois was the largest corn-producing State in 1993, and the largest soybean-producing State in 11 of the last 25 years (NASS/USDA).

Table 5—Inshipments of hogs for selected States, 1980-2003

Year	Iowa	Indiana	Minnesota	Nebraska	Illinois	N. Carolina	U.S.
<i>1,000 head</i>							
1980	1,740	549	226	360	510	45	4,628
1985	1,400	297	288	246	231	58	3,593
1990	1,400	240	262	430	359	403	4,317
1995	3,300	334	770	390	600	203	7,557
1996	4,600	341	1,130	280	700	125	10,036
1997	7,000	439	1,470	275	1,200	153	14,935
1998	9,500	660	2,010	270	1,280	154	19,378
1999	10,700	890	2,650	630	1,530	149	22,634
2000	11,600	1,050	3,150	730	1,470	171	24,514
2001	13,000	1,100	4,050	750	1,600	158	26,745
2002	14,800	1,310	4,550	900	1,530	250	29,434
2003	15,200	1,620	5,350	900	1,790	310	31,464

Source: USDA, *Agricultural Statistics*, various years.

transporting 260-lb. slaughter hogs. So just as livestock follows grain, packer/processors follow livestock.

Corn Belt producers have a long history of purchasing feeder pigs from neighboring States.⁵ Inshipment⁶ data for 1980-2003 show that Iowa in particular has been the primary destination for the largest number of feeder pigs (table 5), averaging 39 percent of total U.S. shipments.

Over the past 10 years, Iowa's feeder pigs shipped in from U.S. sites have declined, while inshipments from Canada have increased (table 6). In 1994, 92 percent of Iowa's inshipped feeder pigs were of U.S. origin, and about 8 percent were imported from Canada. In 2003, 82 percent of Iowa inshipments came from other U.S. States, while Canada's share had grown to 18 percent.

In addition to Canada's gains, Illinois, and Oklahoma, increased the proportion of feeder pigs supplied to Iowa finishers. Illinois' share in 2003 was 11 percent, versus less than 2 percent in 1994. But other States are clear losers, Missouri and Nebraska in particular (table 6). States accounting for small shares of Iowa's feeder pig inshipments in 1994 and located the farthest from Iowa—Arkansas, Colorado, Georgia, Kansas, and “Others”—had all lost market share by 2003. Apparently, competition in the Iowa feeder pig market marginalized the smaller, more distant suppliers first.

A New Role for Feeder Pigs in a Changing U.S. Pork Industry

USDA data (tables 2-5) establish the Corn Belt- Iowa in particular- as a historic demander and supplier of feeder pigs, with bordering States—and the

⁵ *The U.S. Pork Sector: Changing Structure and Organization*, Marvin Hayenga et al. Iowa State University Press, Ames, Iowa, 1985.

⁶ Inshipments are livestock shipped into States for feeding or breeding. Animals brought in for immediate slaughter are not included.

Table 6—Market share of imported feeder pigs for Iowa, 1994-2003

State/Province of origin	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
<i>Percent</i>										
Arkansas	5.0	3.0	4.0	2.2	1.5	1.2	1.6	1.9	2.6	1.9
Colorado	6.1	3.5	2.7	2.6	2.5	2.7	3.7	2.1	2.1	3.3
Georgia	2.7	3.2	1.8	1.6	0.4	1.1	0.7	0.7	0.6	0.9
Illinois	1.8	3.6	9.0	13.1	12.7	11.2	11.6	11.2	10.5	11.4
Kansas	2.8	2.3	1.9	2.1	2.1	1.7	2.0	1.2	1.2	1.2
Minnesota	13.3	10.2	9.2	8.3	7.8	10.3	11.8	12.8	11.6	13.9
Missouri	28.2	34.5	33.0	31.5	25.5	23.5	20.3	19.0	18.2	16.0
Nebraska	0.0	12.4	10.7	8.7	7.2	7.0	7.9	8.8	9.5	7.5
N.Carolina	6.1	5.7	9.8	10.9	12.7	10.0	9.1	9.7	8.3	6.4
Oklahoma	4.1	2.7	4.2	3.1	9.1	12.6	11.2	11.8	9.9	10.2
S.Dakota	3.3	1.8	1.2	1.0	1.2	1.9	2.5	2.8	3.3	2.7
Texas	0.4	0.3	0.3	0.2	1.4	0.9	0.6	0.7	1.6	2.0
Wisconsin	2.1	1.6	1.7	1.8	1.4	0.8	0.7	0.8	1.1	0.9
Other	15.8	6.6	4.6	6.3	4.5	5.2	6.6	5.3	4.8	4.4
Canada	8.3	8.7	5.8	6.5	10.0	9.8	9.4	11.2	14.9	17.5

Source: Iowa Department of Agriculture.

Canadian Province of Manitoba—increasingly important suppliers. Feeder pigs are more prominent in Iowa pork production recently because the Iowa pig crop declined 36 percent between 1980 and 2003 (fig. 5). Inshipped feeder pigs are necessary to maintain slaughter rates. The reduction in the Iowa pig crop is indicative of ongoing structural change in the U.S. pork industry.

Until the mid-1980s, the U.S. pork industry consisted of a hog production component comprised of many small, independently owned, farrow-to-finish operations, and a packing/processing component with sufficient year-round processing capacity to accommodate large fall-winter slaughters. The current U.S. pork industry is comprised of fewer, larger hog production and hog packer/processor operations, with production and processing vertically coordinated via contracting arrangements in order to reduce risk and to optimize year-round slaughter capacity. This current structure is the product of competition and the realization that lower costs can be achieved via large-scale, specialized production and processing operations.

Advancing technology and the exit of small farrow-to-finish operations from the pork industry led to a dramatic reduction in U.S. breeding herd numbers (fig. 6). From 1980 to 2003, the breeding herd of U.S. swine declined by 34 percent. The “new” structure of hog production in the U.S. operates from a base of fewer, larger, specialized operations that derive significant cost savings from realized scale economies. The breeding herds that underlie the new industry structure are products of state-of-the-art breeding and genetic technology and are managed aggressively for maximum productivity using new technologies relating to breeding, nutrition, health, housing, and environmental management.

Figure 5. Iowa inshipped feeder pigs, pig crop, and hog slaughter, 1980-2003

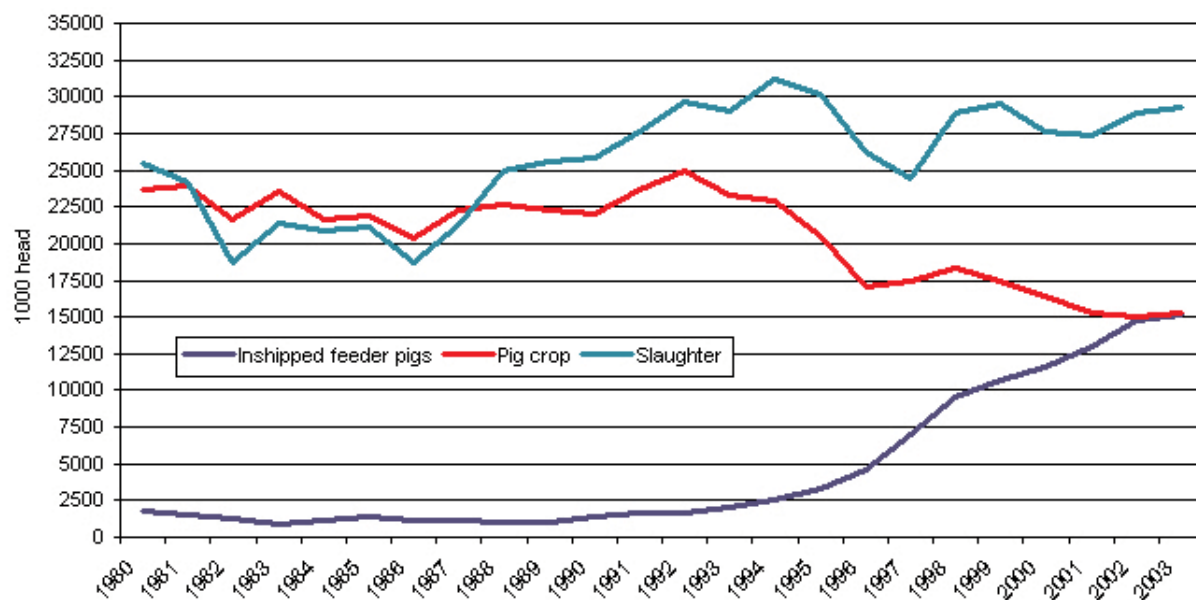
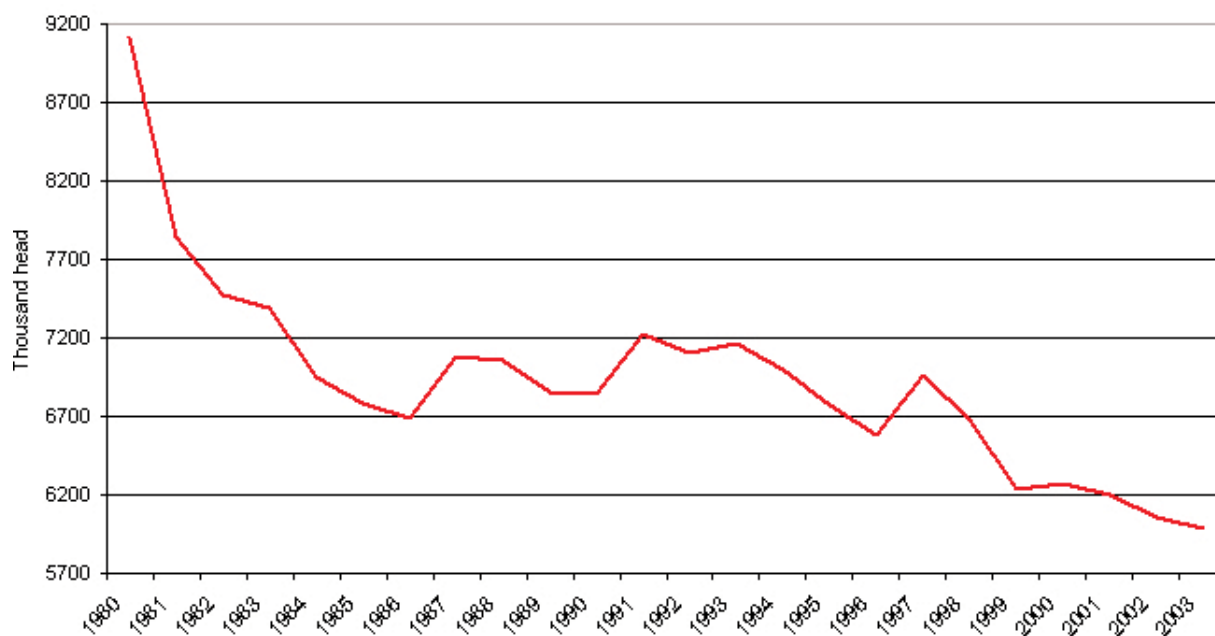


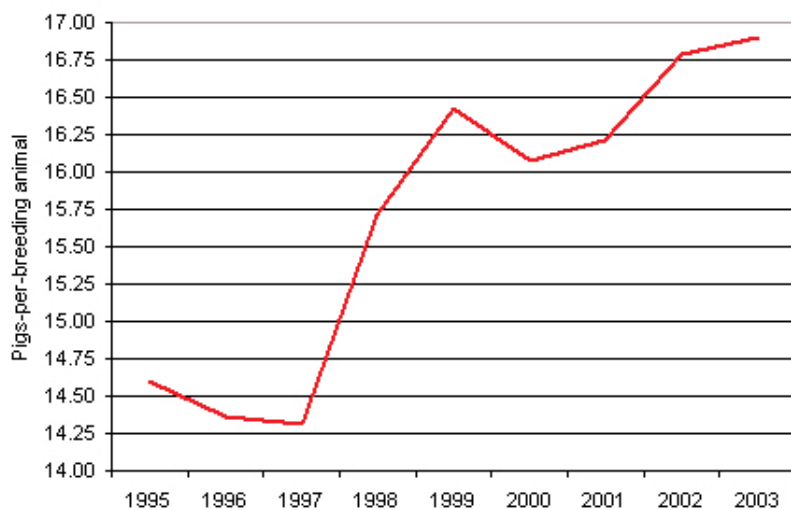
Figure 6. Average U.S. breeding herd, 1980 - 2003



Source: USDA.

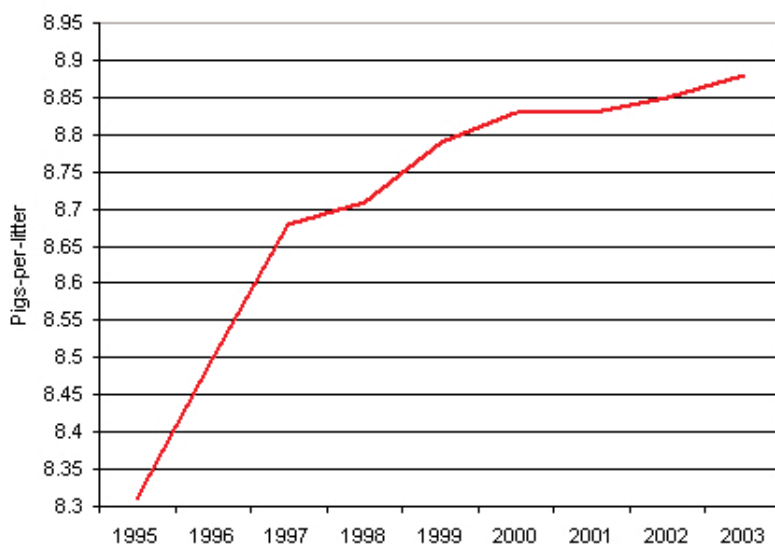
Breeding herd productivity data recently published by USDA's National Agricultural Statistics Service (NASS) demonstrate the impact of new technology adoption and the exit of small farrow-to-finish operations. For example pigs per breeding animal per year grew 19 percent over 1995-2003 (fig. 7) and pigs per litter grew 7 percent over the same period (fig. 8). These productivity increases in the U.S. breeding herd have partially offset the decline in breeding herd numbers. Fewer breeding animals produce more pigs than just 10 years ago.

Figure 7. Annual U.S. pigs per breeding animal per year, 1995 - 2003



Source: USDA.

Figure 8. U.S. Pigs per litter, 1995 - 2003

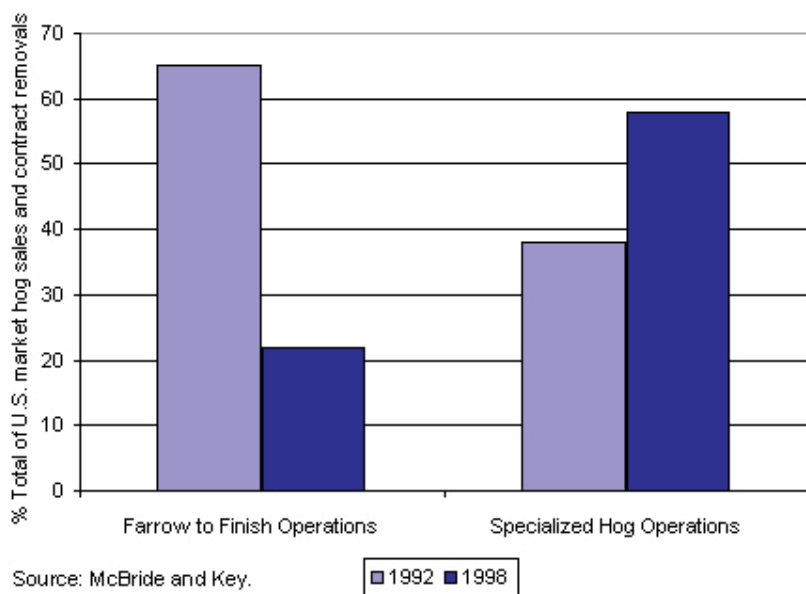


Source: USDA.

Hog production operations specializing in one phase of production have become the dominant model in U.S. hog production. The proportion of total market hogs produced from farrow-to-finish operations fell from 65 to 38 percent between 1992 and 1998, while production from specialized hog operations increased from 22 to 58 percent (fig. 9).⁷ This trend toward specialization likely derives from its suitability to large-scale production and economies of scale. Consequently, the demand for feeder pigs by specialized hog-finishing facilities in Corn Belt States has increased.

⁷ *Economic and Structural Relationships in U.S. Hog Production*. William D. McBride and Nigel Key, Econ. Res. Serv./USDA. AER-818, Feb. 2003.

Figure 9. U.S. hog and pig production by producer type, 1992 and 1998



The Packer/Processor Stage Has Changed Also

The same set of economic forces that drives structural change in U.S. hog production has affected packer/processors. Competition has made minimizing cost—particularly at the slaughter end of the industry—imperative. So in the last 20 years, packer/processors have pursued scale economies to lower per unit costs. Many smaller, older packing operations have given way to a packer/processing sector structured around a smaller number of newer, very large facilities.

The operating objective of the restructured U.S. packer/processors is to maximize slaughter numbers year-round to lower total fixed costs, thereby reducing the total cost of plant operation. This is a departure from the industry's past willingness to maintain excess slaughter capacity underutilizing facilities for almost three quarters of the year (January-August) in order to accommodate seasonally large fall-winter (September-December) slaughter levels. Currently the industry accommodates large fall-winter slaughters by adding a second shift, and/or by slaughtering animals on Saturdays. "Chain speeds" are also accelerated during periods of high demand so that more animals are killed and processed within given time periods. Thus, rather than holding excess capacity for periods of high slaughter demand, the industry uses slaughter capacity more intensively.

The imperative to maximize throughput, yet still maintain capacity to accommodate heavy slaughter periods, causes U.S. packing facilities to bid up the price of hogs. Strong slaughter demand, and the relatively high hog prices that result, are a major factor behind imported Canadian feeder pigs and slaughter hogs. Whereas, years ago, hog prices now bid by packers were profitable for producers located close to a slaughter plant, prices bid

by packers to maintain throughput often compensate producers located farther from the plant. Prices bid by slaughter facilities in Iowa and Kentucky are often attractive to producers as far away as Manitoba and Ontario.

The lower relative cost base of the U.S. slaughter industry, relative to Canada's, allows U.S. packers to consistently bid aggressively for hogs, and thus drives U.S. live hog imports. The cost advantage of the U.S. slaughter industry derives partly from flexible work rules that allow Saturday slaughters and second shifts, neither of which has ever been common practice in Canada. Thus, despite dramatic reductions in wage costs in the Canadian slaughter industry in 1998-99,⁸ U.S. packers appear to be able to bid a significant number of Canadian slaughter hogs into the United States. Canadian slaughter hogs continue to constitute more than a third of U.S. hog imports. This year, U.S. packers are expected to import more than 2.5 million Canadian slaughter hogs.

⁸ Settlement of labor actions, in 1998 and 1999, resulted in wage and benefit concessions ranging between 35 and 40 percent.

The Pork Industry in Canada: A Brief Comparison

The U.S. hog inventory is currently about four times larger than Canada's (tables 7a and 7b). Twenty-five years ago, however, the U.S. had almost seven times more hogs than Canada, reflecting how rapidly Canadian hogs inventories have expanded in recent years. In 1980, the United States had more than eight times more breeding animals than Canada. Currently, the U.S. breeding herd is just 3.7 times larger than Canada's, indicating the simultaneous expansion in Canada and exit of small farrow-to-finish operations from U.S. hog production. In 1980, U.S. packer/processors slaughtered seven times more hogs than Canadian operations. In 2003, U.S. slaughter numbers led Canada by a factor of 4.6, showing the relative (and absolute) expansion of Canadian slaughter capacity (table 7b).

Table 7a—Comparison of U.S. and Canadian pork sectors

Item	1980	1990	1995	2000	2001	2002	2003
<i>Million pounds</i>							
U.S. pork exports to Canada/ Canada imports from U.S.		42	23	58	139	186	188
US pork imports from Canada/ Canada exports to U.S.	0	437	454	737	766	880	971
U.S. pork trade balance	42	-414	-396	-598	-580	-692	-780
<i>Percent</i>							
Canada share of U.S. exports	16.6	9.6	7.3	10.8	11.9	11.7	11.1
Canada share of U.S. imports	na	48.7	68.4	76.2	80.6	82.3	81.9
Canada export share of production	14.4	27.7	28.7	40.2	42.1	46.6	51.8
U.S. export share of production	1.51	1.55	4.41	6.79	8.15	8.19	8.60

Source: USDA and Statistics Canada.

Table 7b—Comparison of U.S. and Canadian pork sectors

Item	1980	1990	1995	2000	2001	2002	2003	2004*	2005*
Inventory (1,000 head)									
Canada	10,091	10,392	11,291	12,904	13,576	14,367	14,672	14,623	14,900
U.S.	67,319	53,788	59,738	59,335	59,110	59,722	59,554	60,449	60,700
(US/CN)	6.7	5.2	5.3	4.6	4.4	4.2	4.1	4.1	4.1
Breeding herd (1,000 head)									
Canada	1,143	1,086	1,195	1,346	1,406	1,512	1,568	1,617	na
U.S.	9,645	6,857	6,998	6,233	6,267	6,201	6,058	5,990	na
(US/CN)	8.4	6.3	5.9	4.6	4.5	4.1	3.9	3.7	na
Slaughter (1,000 head)									
Canada	13,978	14,683	15,771	19,684	20,704	22,103	22,464	22,600	22,900
U.S.	97,174	85,391	96,326	97,976	97,963	100,263	100,931	103,750	105,125
(US/CN)	7.0	5.8	6.1	5.0	4.7	4.5	4.5	4.6	4.6
Production (Mil. pounds)									
Canada	2,280	2,498	2,813	3,616	3,816	4,087	4,149	4,189	4,266
U.S.	16,616	15,355	17,849	18,951	19,160	19,685	19,965	20,574	20,970
(US/CN)	7.3	6.1	6.3	5.2	5.0	4.8	4.8	4.9	4.9
Consumption (lbs. per capita)									
Canada	81	66	70	74	76	74	69	71	72
U.S.	74	64	67	66	65	66	67	67	67
(US/CN)	0.9	1.0	1.0	0.9	0.9	0.9	1.0	0.9	0.9
Imports (Mil. pounds)									
Canada	49	26	68	150	201	201	201	243	243
U.S.	549	897	664	968	950	1,069	1,186	1,116	1,116
(US/CN)	11.3	33.9	9.7	6.5	4.7	5.3	5.9	4.6	4.6
Exports (Mil pounds)									
Canada	328	692	807	1,455	1,605	1,905	2,150	2,116	2,161
U.S.	251	238	787	1,287	1,561	1,612	1,717	2,068	2,114
(US/CN)	0.8	0.3	1.0	0.9	1.0	0.8	0.8	1.0	1.0

na = not available.

* Forecast

Source: USDA and Statistics Canada.

The Canadian pork sector is highly dependent on trade. Canada currently exports more than half of its pork production; by comparison, the U.S. exported about 9 percent of its production in 2003. Currently, more than 80 percent of U.S. pork imports are of Canadian origin, whereas Canada accounts for 11 percent of U.S. pork exports. On the other hand, the data show that the United States is, by far, a net importer of pork—and hogs—from Canada.

Policy Change in Canada Created Hog Production Opportunities

An excess supply of hogs in Canada did not come about solely in response to structural change in the United States. Indeed, excess U.S. demand for

live hogs began to evolve at roughly the same time that Federal and Provincial governments in Canada started to trim back subsidy support for agriculture.

Policy change in Canada is key in the creation of incentives that brought about expansion of the Canadian hog industry, particularly into the Western Provinces. The Canadian Government sharply reduced its subsidies to agriculture in the mid-1990s, both to reduce the Federal deficit and to meet its WTO commitments. The 1995 abolition of the Western Grain Transportation Act (WGTA) created an incentive to produce livestock in the Western Provinces, a region historically dedicated to grain production. The WGTA subsidized rail transport of grain produced in Western Provinces to coastal export points. The absence of transport subsidies made shipping wheat and barley less profitable. Marketing grain through livestock—particularly hogs—provided a profitable alternative use for grain.

Currently, large quantities of Canadian wheat and barley are fed to livestock, in regions that, prior to 1995, had been devoted primarily to grain. The standout example of this market response is Manitoba's hog industry. Inventories of hogs and pigs in Manitoba increased over 78 percent between 1995 and 2004. Its breeding herd increased more than 105 percent over the same period. Manitoba is the primary source of imported Canadian feeder pigs.

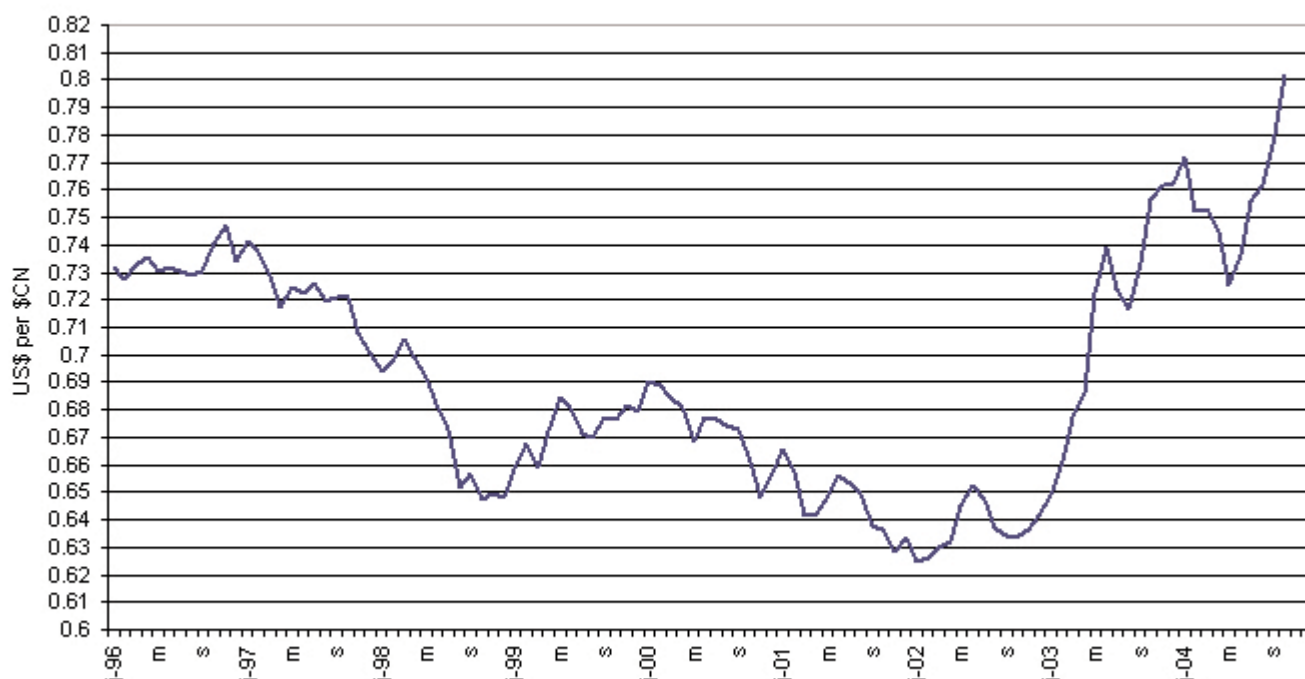
In addition to virtually launching a hog industry in Manitoba, the reduction of agricultural subsidies in Canada—on both a Federal and Provincial level—also forced the United States to cut its countervailing duty (CVD) on imported Canadian hogs. The United States imposed the CVD in 1985 to balance Canada's subsidy support of its hog producers. Lower subsidy support in Canada obliged the United States to reduce the CVD from about \$5.63 per imported Canadian slaughter hog in 1992-93 to a *de minimis* level in 1996-97. The absence of the CVD opened the U.S. border to Canadian hogs and feeder pigs.

The U.S.-Canadian Dollar Exchange Rate: Premiums for Canadian Sellers, Discounts for U.S. Buyers, 1996-2002

The U.S.-Canadian dollar exchange rate provided as significant an incentive for expansion of Canadian hog production as policy change in Canada and structural change in the United States. The role of the exchange rate is central because in comparison to the U.S. pork industry, pork production in Canada is a small “price taker” industry. This means that Canadian hog prices are set in the United States, with the Canadian industry having little to no effect on prices of hogs and feeder pigs produced in Canada. Provincial producer boards⁹ and/or Canadian packer/processors base prices paid to producers on hog prices established in daily U.S. markets, multiplied by the Canadian dollar-per-U.S. dollar exchange rate. Feeder pig prices in Canada are also based on prices established in U.S. markets.

⁹ In particular, the Ontario Pork Board (<http://www.ontariopork.on.ca/ProducersInfo/Contracts/priceformula.htm>) and Fédération des producteurs de porcs du Québec (www.leporcduquebec.qc.ca/pages/MMPage-mmCONVENTION.html)

Figure 10. US-Canada dollar exchange rate, 1996 - 2004



Source: Federal Reserve Bank of New York.

Between November 1996 and January 2002, the U.S. dollar appreciated almost 20 percent against the Canadian dollar, from 75 cents per Canadian dollar in November 1996, to 62.5 cents in January 2002 (fig. 10). Because the price Canadian hog producers receive for their animals is simply the U.S. price multiplied by the exchange rate, producers captured a positive exchange rate premium between 1996-2002, whether they sold animals in the United States or not. The 1996-2002 exchange rate premiums provided a strong incentive for increased production of feeder pigs and hogs in Canada.

The premiums created by an appreciating U.S. dollar, coming at a time when the Canadian hog export business was establishing commercial links in the United States, was likely a powerful marketing tool for sellers of Canadian hogs. Sellers of Canadian hogs could use the exchange rate premium to enhance the competitiveness of Canadian feeder pigs in Iowa, for example, against pigs grown in the United States. U.S. hog finishers benefited from the competition between sellers of Canadian and domestic feeder pigs by paying lower prices for feeder pigs than might have otherwise been the case.

In January 2002, the Canadian dollar bottomed out and began a steady appreciation against the U.S. dollar that continued through 2004. Since early 2002, the Canadian dollar has appreciated more than 28 percent against the U.S. dollar. Because the depreciated U.S. dollar translates into fewer Canadian dollars, Canadian hog/feeder pig producers have been receiving lower prices for more than 2 years. What has been the result? The flow of Canadian hogs has yet to slow (table 1), but a lagged price

response is not unusual. Ocean liners can't turn on a dime, and neither can most large, complex industries. Production responses to persistently lower prices often take several years to appear. However Statistics Canada has been reporting a slowdown in the rate of expansion of the Canadian breeding herd since early 2002. Also, two large operations—Premium Pork and Acre T Farms—have recently gone into receivership.

The rise in the value of the Canadian dollar appears to have hurt Canadian pork products in Asian markets, particularly Japan, the world's largest pork importer. U.S. pork products are becoming more competitive against Canadian pork. When Canadian pork exports began to slow in 2003, slaughter margins of Canadian processors decreased, obliging them to offer lower prices for hogs. Canadian hog producers responded by exporting more slaughter hogs to the United States.

Whichever direction the Canadian dollar goes, exchange rates will continue to affect the quantity and type of Canadian hog (i.e., feeder pig vs. slaughter hog) traded in the United States. For the present, one of the major challenges facing the Canadian pork industry will be to maintain the international competitiveness of an export-dependent industry built on a 68-cent Canadian dollar, at a time when the exchange rate has increased to 80 cents and above.

Slaughter Capacity Deficit in Canada Shifted Production Toward Live Export

A scarcity of Canadian slaughter capacity, compared with hog production capacity has also contributed to the creation of excess hogs in Canada. Although Canada's slaughter capacity has increased significantly in the past 5 years, its growth lags that of hog production. In 1995, slaughter capacity in Canada was roughly 16 million head per year. In 2003, the Canadian pork industry slaughtered and processed more than 22 million hogs, a 38-percent increase over 1995. Hog production in Canada however, as measured by annual pig crop, has increased from 21 to 34 million hogs over the 9-year period, an increase of 66 percent.

The computed ratio of pigs-to-slaughter capacity brings these different expansion rates between stages of the Canadian pork industry into sharper focus. In 1995, there were 1.27 pigs per slaughter space in Canada. In 2003, that ratio had grown to 1.53, despite significant expansion of the Canadian slaughter industry.¹⁰ The increased ratio reflects the rapid growth of a significant share of Western Canada's new hog production capacity that is specifically dedicated to raising feeder pigs for export to the United States. Clearly, at current prices, Canada's capacity to produce hogs exceeds its capacity to profitably slaughter and process them.

¹⁰ In particular, Maple Leaf Foods built a state-of-the-art slaughter facility in Brandon, Manitoba, which opened in 1999. The facility is currently slaughtering about 40,000 animals per week, and recently received approval for the necessary licenses from the Manitoba Clean Environment Commission to expand to a two-shift operation.

Canadian Hog Breeders More Efficient than U.S.

Production efficiencies in the Canadian breeding herd have also contributed to the competitiveness of Canadian hogs in U.S. markets. Indicators of technical efficiencies, computed using data from Statistics Canada (www.statcan.ca/english/freepub/23-010/XIE/free.htm), show Canadian breeding herds to be significantly more efficient than U.S. herds, as measured by pigs per litter and pigs per breeding animal per year. The U.S. breeding herd has, according to USDA statistics (<http://usda.mannlib.cornell.edu/reports/nassr/livestock/hog-herd/spehog02.pdf>), also become more efficient with the exit of small, inefficient farrow-to-finish operations. However, there remains a wide disparity between Canadian and U.S. efficiency indicators, demonstrating why Canadian feeder pigs in particular are so competitive in the United States.

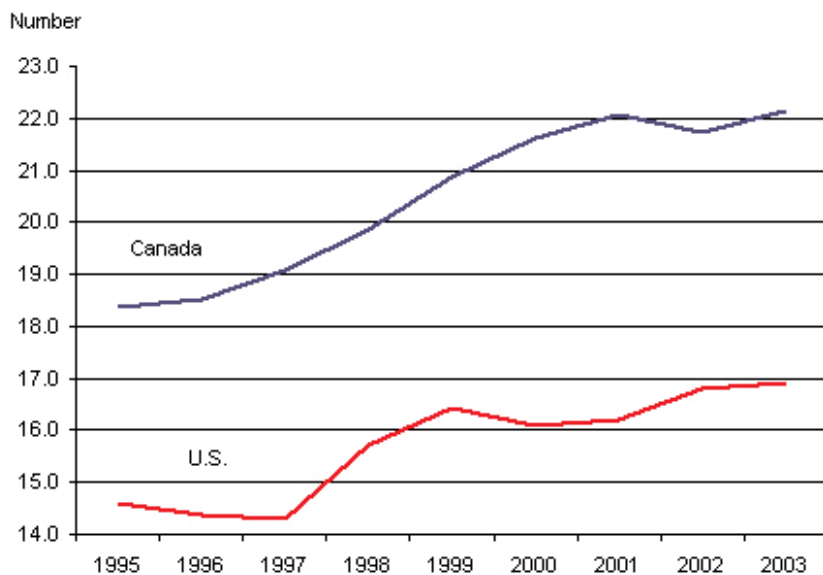
In 1995, a Canadian breeding animal produced 4.1 more pigs per year than a U.S. breeding animal (fig. 11). By 2003, that gap had widened to 5.2 pigs per animal per year. The number of pigs per litter tells the same story (fig. 12). Canada's breeding herd produces 1 pig per litter more than U.S. herds on farms with more than 5,000 head, operations assumed to be most able to take full advantage of scale economies. Canada's greater breeding efficiency contributes to dramatically lower production costs, which in combination with favorable exchange rates, enabled Canadian feeder pigs to gain a significant share of the Corn Belt market.

The cool Canadian climate and lower herd densities also likely contribute to the greater efficiency of Canadian breeding herds. Both factors serve as powerful dampers on the development and spread of disease. Cooler weather also improves lactation quantity and quality in nursing sows, enhancing litter health.

In Manitoba, hog operations are typically located many miles apart. In Iowa and southern Minnesota, the primary destinations of most feeder pigs sold in the United States, breeding operations are often separated by less distance, increasing the probability that a disease will spread to adjoining operations. In the event of a disease outbreak in Corn Belt States, overall breeding herd productivity suffers, particularly when disease spreads between operations.

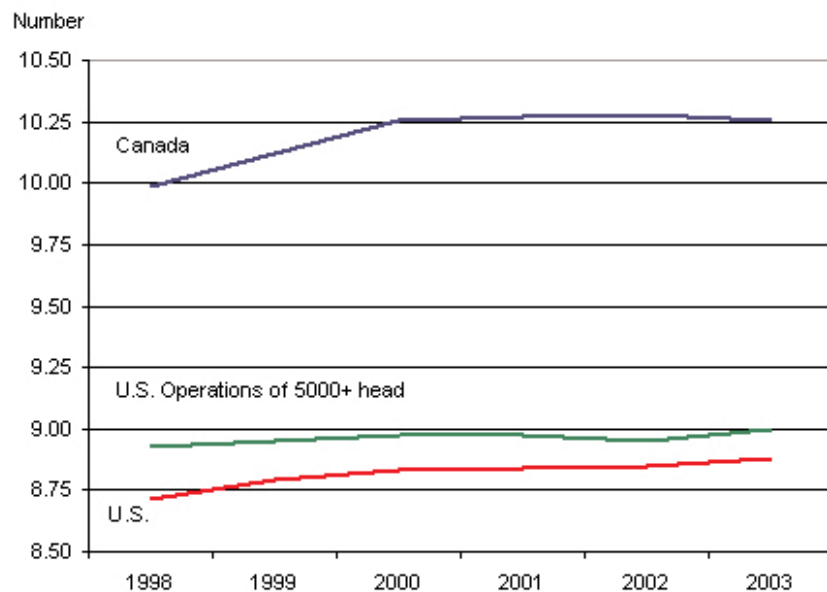
Swine diseases are extremely difficult to eradicate once they have become established in a herd, or even in a set of buildings. Thus, from a disease standpoint, U.S. hog producers are at a disadvantage with respect to Canadian hog producers. Hogs have been raised in the Corn Belt for more than a century, whereas the hog industry in Western Canada is relatively new and swine diseases are not as significant.

Figure 11. Annual pigs per breeding animal: U.S. and Canada, 1995-2003



Source: USDA, Statistics Canada.

Figure 12: Pigs per litter: U.S. and Canada, 1998-2003



Source: USDA and Statistics Canada.

North American Hog Production: An Application of the Theory of Comparative Advantage

Structural change in the U.S. pork industry, policy change in Canada, and exchange rate dynamics together created incentives for pork production in the United States and Canada, and the necessity for those engaged in the industry to adjust to a new economic environment. The result is a largely integrated North American pork industry, with particularly close cross-border links in hog production. Many economists would argue that North American hog production as it has evolved over the past 20 years is an application of the theory of comparative advantage. The theory states that an economically efficient region produces those goods whose production process is intensive in the inputs most abundant in that region. Thus, Canada specializes in farrowing, an aspect of hog production where Canadian operations hold an apparent advantage for reasons of climate, operation density, etc., compared with Corn Belt States. On the other hand, Corn Belt States offer abundant and relatively stable supplies of corn and soybeans, and thus Corn Belt production operations tend to specialize in finishing feeder pigs. The integration of North American hog production results in more hogs and pigs produced at lower costs, which creates the potential for greater benefits to North American producers and consumers.

National Pork Producers Council Alleges Illegal Subsidies and Dumping

On March 5, 2004, the National Pork Producers' Council (NPPC), along with 19 State pork producer organizations and more than 100 individual U.S. pork producers, filed petitions with the U.S. Department of Commerce (DOC) and the International Trade Commission (ITC) arguing that, in 2003, Canadian hogs and feeder pigs established market share in the United States by using illegal subsidies from the Federal and Provincial governments of Canada, and by selling slaughter hogs and feeder pigs in the United States at less than fair value. The petition requests trade relief in the form of antidumping and countervailing duties, each of which, if imposed, would effectively increase U.S. prices of feeder pigs and slaughter hogs imported from Canada.

Investigations of these claims are underway at both the DOC and the ITC. The DOC investigations make preliminary and final determinations on countervailing duty (CVD) and anti-dumping (AD) questions. The CVD question concerns the legality of financial support given to Canadian hog producers by the Federal and Provincial governments of Canada, and whether CVDs should be levied to compensate U.S. producers for Canadian subsidy support. The AD question concerns whether Canadian hogs were sold in the United States at selling prices of less than fair value in 2003, thus necessitating the assessment of anti-dumping penalties. The preliminary and final ITC determinations focus on whether imported Canadian

hogs either materially injured or threatened material injury to the U.S. hog production industry in 2003.

On May 3, 2004, the ITC made a preliminary determination that "...there is a reasonable indication that an industry in the United States is materially injured by reason of imports from Canada of live swine..." In August 2004 the DOC announced a negative preliminary determination in its CVD investigation, meaning that it found no illegality in Canadian subsidy programs. However, in October 2004, DOC made a positive preliminary determination with respect to the AD charge, finding that Canadian hogs were sold at below fair value in 2003. On this basis, Canadian exports of live hogs to the United States have been required since late October to post a cash deposit or a bond equal to AD penalties in amounts equal to roughly 14 percent of the value of the imported Canadian hog or feeder pig.

Final determinations from DOC on the CVD and the AD investigations are due in early March 2005. The ITC final determination concerning injury to the U.S. hog production industry is due in late April 2005. If DOC makes affirmative determinations in either the CVD or the AD investigations, and the ITC makes an affirmative final injury determination, countervailing duties and/or antidumping penalty orders will be issued with duties and penalties assessed and collected at the border for distribution to U.S. hog producers, in accordance with the Byrd Amendment.¹¹

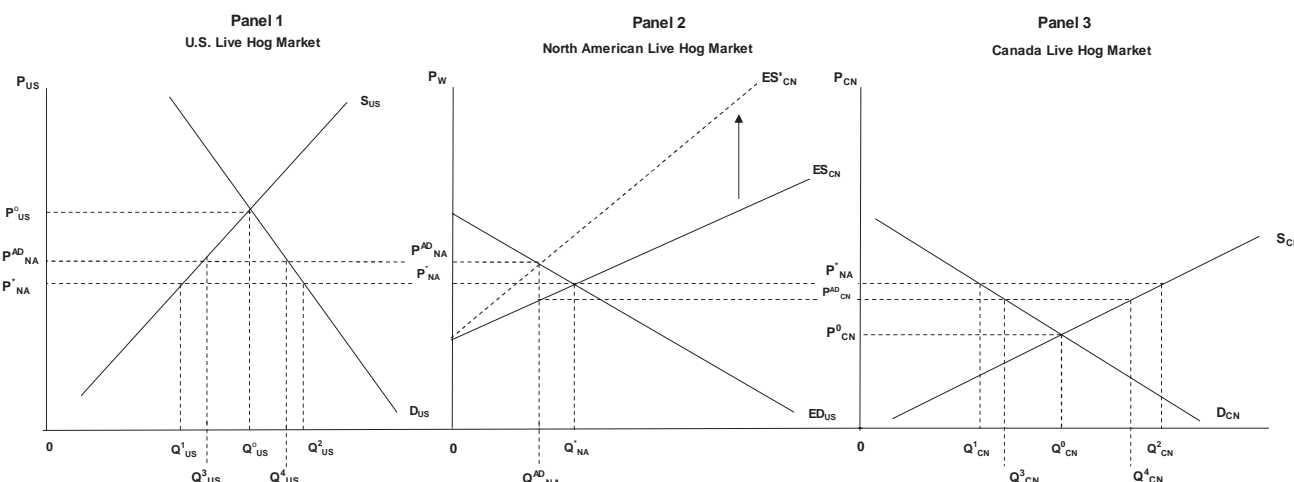
With ITC and DOC investigations ongoing, it is difficult to forecast the precise effects of potential duties and penalties. In this case though, trade theory is useful in analyzing the short-run effects of the anti-dumping duties now in place. Figure 13 depicts the North American hog market in a three panel diagram. The model makes the simplifying assumptions that "hogs" are a single, homogeneous good. In the figure, panel 1 shows the U.S. hog market, panel 3 depicts the Canadian hog market, and panel 2 represents the North American hog market. The U.S. and Canadian live hog markets are each depicted by supply and demand curves. Before markets are opened to trade, equilibrium is achieved in the U.S. and Canadian markets by adjustments in domestic live hog prices until the quantity of live hogs demanded is equal to the quantity of live hogs supplied by domestic producers. Domestic markets equilibrate quantity supplied and quantity demanded in the U.S. market at price P_{US}^0 , and in Canada at price P_{CN}^0 . By assumption, Canada is a relatively lower cost hog producer in this example, with P_{CN}^0 less than P_{US}^0 . This assumption is based on Canadian breeding herd efficiency evidence presented above and on the August 2004 negative preliminary determination by DOC with respect to Canadian Government subsidies to Canadian hog producers. At equilibrium before trade, the U.S. produces Q_{US}^0 hogs, and Canada produces Q_{CN}^0 hogs.

In panel 2, the North American market is depicted by a U.S. excess demand curve, and a Canadian excess supply curve.¹² The U.S. excess demand curve, labeled ED_{US} , represents U.S. demand for live hogs below the domestic market clearing price of P_{US}^0 . At prices lower than P_{US}^0 , the quantity of live hogs demanded exceeds the quantity supplied by domestic hog producers. The Canadian excess supply curve labeled ES_{CN} depicts quantities of live hogs that Canadian producers are willing and able to sup-

¹¹ The Byrd amendment directs the U.S. Government to distribute collected anti-dumping duties to the U.S. organizations that initiated the petition.

¹² For simplicity, the exchange rate is fixed at 1:00; that is, 1 U.S. dollar is equal to 1 Canadian dollar.

Figure 13. 3-Panel diagram of North American live hog market



ply at prices above P^0_{CN} . When live hogs are traded between the United States and Canada, the North American market equilibrates at price P^*_{NA} , the point of intersection between U.S. excess demand curve ED_{US} and Canada's excess supply curve ES_{CN} . The North American price of hogs, P^*_{NA} , is greater than P^0_{CN} but less than the U.S. market-clearing price prior to trade, P^0_{US} . Trade is advantageous to Canadian hog producers because the domestic Canadian price of live hogs has increased from P^0_{CN} to P^*_{NA} . U.S. buyers of live hogs (Corn Belt hog finishers, and packer/processors) benefit from trade because imports of live hogs lower the domestic hog price from P^0_{US} to P^*_{NA} .

With trade, and hog prices equal to P^*_{NA} , Q^*_{NA} hogs are traded in the North American market. Canadian hog producers supply Q^1_{CN} hogs to Canadian buyers and $Q^1_{CN}Q^2_{CN}$ to the North American market. U.S. buyers purchase Q^1_{US} from U.S. hog producers, and $Q^1_{US}Q^2_{US}$ from the North American market. In this model, the North American market-clearing quantity, Q^*_{NA} , is equal to the quantity of live hogs imported by U.S. buyers— $Q^1_{US}Q^2_{US}$ —and to the quantity of hogs exported by Canadian hog producers— $Q^1_{CN}Q^2_{CN}$.

When the United States imposes anti-dumping duties on imports of live Canadian hogs, the incidence of the duty is borne largely by Canadian producers, because of the shortrun absence of marketing alternatives in Canada—that is, limited finishing space for feeder pigs, limited slaughter capacity for slaughter hogs, and the inability to “store” live animals. In the three-panel diagram, the imposition of the anti-dumping duties is depicted with an upward rotation of Canada's excess supply curve.¹³ The consequence of the anti-dumping duties is fewer hogs traded. In panel 2, the quantity of hogs traded is reduced to Q^{AD}_{NA} from Q^*_{NA} . U.S. hog buyers import fewer hogs ($Q^3_{US}Q^4_{US}$) and buy more domestic hogs Q^3_{US} while paying higher prices— P^{AD}_{NA} —for the hogs they buy. Canadian hog producers sell more hogs domestically (Q^3_{CN}), export fewer ($Q^3_{CN}Q^4_{CN}$), and receive a lower price— P^{AD}_{CN} —for the hogs they sell. With the anti-dumping duty in place, U.S. hog prices increase to benefit U.S. hog produc-

¹³ The excess supply curve is perceived by U.S. demanders to have shifted upward by the percentage value of the anti-dumping duty.

ers, to the detriment of U.S. hog buyers. In Canada, domestic hog prices decline, to the benefit of hog buyers and the detriment of producers.

The simple three-panel diagram shows general short-term effects that could result from the anti-dumping duties imposed by the United States on imported Canadian hogs on October 20, 2004. While medium- and long-term effects of trade restrictions are exceptionally difficult to forecast, permanent dumping penalties and/or non-zero countervailing duties would likely slow the rate of North American pork market integration. Also, ensuing price changes could drive U.S. resources toward the farrowing stage of hog production and Canadian resources toward feeder pig finishing and slaughter hog processing.

Conclusions

An unusually powerful set of incentives for development of slaughter hog and feeder pig trade between Canada and the United States, among them:

- The structural shift toward specialized operations in U.S. hog production
- the decline in the U.S. breeding herd numbers and increased demand for feeder pigs in the United States,
- policy changes in Canada created incentives to expand hog production
- The development of cost-competitive production in Canada
- Canadian proximity to major hog-finishing areas of the United States, and
- Favorable exchange rates between the U.S. and Canadian currencies.

Canada's abolition of the Western Grain Transportation Act in 1995 attracted investment into Western Canada where the existing resource base—vast open spaces, low population density, and a cool climate—favored modern hog production. Canada's policy changes have resulted in an industry capable of producing more hogs than—at current prices—can be profitably finished and slaughtered in Canada.

The U.S. pork industry has also undergone significant changes in the last 20 years resulting in packer/processor demand for hogs in excess of U.S. supply. The restructuring has meant a shift from many smaller farrow-to-finish operations in Corn Belt States to fewer, often very large operations that specialize in one stage of hog production. Finishing operations are particularly prevalent because they are conducive to large-scale production and scale economies. Moreover, USDA data indicate that demand for feeder pigs derives from finishing operations centered in the Corn Belt—particularly in Iowa—where feed costs are minimized.

For the packer/processor side of the U.S. pork industry, competition caused consolidation and restructuring that has driven smaller, older plants to shut down. Remaining slaughter plants are large, and they are managed to optimize capacity in order to capture scale economies. The second shifts and Saturday slaughters that distinguish the U.S. from the Canadian slaughter industry effectively add to U.S. processors' capacity and flexibility. Indeed, lower costs from labor flexibility likely enable U.S. processors to pay higher

prices for hogs than Canadian processors. Open slaughter space pushes hog prices higher, drawing hogs and feeder pigs from all over North America, as indicated by USDA feeder pig market data. Indeed, higher hog prices in the U.S., due largely to aggressive packer/processor bidding to secure steady supplies of uniform, high-quality hogs, have driven U.S. imports of Canadian feeder pigs and slaughter hogs. Moreover, lower per-unit costs that derive from optimal slaughter plant throughput enable U.S. processors to buy more hogs at higher prices than Canadian packer/processors.

The falling exchange value of the U.S. dollar from late 1996 through early 2002 likely provided something of a windfall to sellers of Canadian hogs. For more than 5 years, the steadily appreciating value of the U.S. dollar conferred a built-in premium to sellers of Canadian pigs.

The U.S. dollar has lost roughly 16 percent in Canadian dollar terms since early 2003. Rather than slowing the flow of live hog trade, however, it appears that the depreciated value of the U.S. dollar has so far only served to change the “mix” of imports—slaughter hogs and feeder pigs—rather than to lower the number of head imported. Slaughter hogs have comprised a higher share of U.S. imports of Canadian hogs since June 2003. Canada is likely exporting more slaughter hogs to the U.S. because the appreciation of the Canadian dollar has reduced the competitiveness of exported Canadian pork products in foreign markets where Canadian pork products compete with U.S. products. Lower foreign demand for Canadian pork products has pressured Canadian processors' slaughter margins, lowering demand for slaughter hogs in Canada. In such an economic environment, U.S. processors provide a viable marketing alternative for Canadian hog producers.

Investigations by the DOC and the ITC have been underway since March 2004, when the NPPC et al. filed a petition alleging illegal subsidies to Canadian hog producers by the Canadian Government, and below-fair-value sales of slaughter hogs and feeder pigs in the U.S. in 2003. The petition requests countervailing duties to compensate U.S. hog producers for illegal Canadian subsidies, and anti-dumping penalties to compensate for below-fair-value sales of Canadian hogs in the U.S. in 2003.

The DOC preliminary determination with respect to Canadian subsidies found that the total net subsidy to Canadian hog producers by the Canadian Government is *de minimus*—that is, negligible and thus too small to be countervailed. The DOC preliminary determination with respect to less than fair-value sales of Canadian hogs in the U.S. in 2003 was positive. As a result, antidumping penalties—bonds or cash deposits equal to the estimated dumping margin of roughly 14 percent—are being collected on imported Canadian slaughter hogs and feeder pigs.

An analysis of *de minimus* subsidies and positive AD penalties in a simple trade model shows U.S. hog prices increase to benefit U.S. hog producers, to the detriment of U.S. hog buyers. In Canada, domestic hog prices decline, to the benefit of hog buyers and the detriment of producers.